Jl S. Afr. Bot. 38 (2): 67–80 (1972)

THE LINNAEAN SPECIES OF *CRASSULA*

H. R. Tölken

(*Botany Dept., University of Cape Town*)

Abstract

Twenty-eight species of *Crassula* as used by Linnaeus are reviewed: three of these do not belong to the genus, one is a European species and twenty-four are South African. Of the latter seven are relegated to synonymy, *C. punctata* is regarded as a nomen confusum, *C. strigosa* and *C. muscosa* must be taken up; *C. tetragona*, *C. subulata*, *C. pruinosa* and *C. perfoliata* are re-interpreted and, as a result, *C. arenicola*, *C. pustulata*, *C. robusta* and *C. perfoliata* var. *miniata* are described.

Uittreksel

DIE *CRASSULA* SOORTE DEUR LINNAEUS BENAAM.

Ag-en-twintig *Crassula*-soorte soos gebruik deur Linnaeus word bespreek: drie daarvan behoort nie aan die genus nie, een is 'n Europese soort en vier-en-twintig is Suid-Afrikaanse soorte. Van laasgenoemdes is sewe sinonieme van ander soorte, *C. punctata* is 'n nomen confusum, die name *C. strigosa* en *C. muscosa* moet gebruik word; die interpretasie van *C. tetragona*, *C. subulata*, *C. pruinosa* en *C. perfoliata* is gewysig en as gevolg daarvan is *C. arenicola*, *C. pustulata*, *C. robusta* en *C. perfoliata* var. *miniata* beskryf.

Schonland's (1929) revision of the genus *Crassula* deals in many cases only superficially with the names used by Linnaeus. However, as they are of nomenclatural importance they are re-evaluated and in this paper they are individually discussed as this gives some insight into the methods used at the time.

Linnaeus delimited the genus *Crassula* clearly, partly because his system was based on the number of stamens which happen to separate this genus from most other genera in the family, and partly because of the intercorollary squamae distinguishing it from other genera outside the family. This, however, does not mean that he had a similar concept of the genus as it is accepted nowadays because in subsequent years various species have been justifiably or otherwise referred to other genera, e.g. *C. dichotoma* to *Vauanthes dichotoma* (L.) O. Kuntze. On the other hand the exclusion of *Septas capensis* because of its heptamerous flowers and *Tillaea* with tetramerous flowers is typical of the rigid way in which plants were classified at the time. A *Cotyledon*, "*C. alternifolia*" was included in *Crassula*, probably because it was described from an illustration.

Linnaeus arranged the species according to their similarities and then numbered them. This meant that everytime a new species was included, the numbering had to be changed, but in Systema Naturae (ed. 13) a more versatile

---

Accepted for publication 13th December, 1971.

system was adopted. The species still had their numbers as in Species Plantarum (ed. 2), but the numerical sequence was abandoned, so that new species with their serial number could be included next to the species it most closely resembled.

Many of the Linnaean species are based on illustrations in Dillenius' Hortus Elthamensis. These drawings should receive preference in the selection of type specimens contrary to Schonland's (1929) suggestions, as the specimens had not been used in the production of the illustrations. Only in the case of *C. perfoliata* where the similarity between the two is unmistakable, the specimen was selected as the lecto type (cf. Clokie 1964, An Account of the Herbaria of the Department of Botany in the University of Oxford p. 93).

In this paper the taxonomy of all species and their names known to Linnaeus are discussed in alphabetical order. Also, a manuscript by Prof. T. T. Barnard on the Linnaean species of *Crassula* (at present housed in the Bolus Herbarium) is referred to, and the present author is greatly indebted to Professor Barnard for the use of this manuscript. In addition, the loan of specimens from Geneva is gratefully acknowledged, as well as access and working facilities at the Linnaean Herbarium, London. The author also wishes to thank the Curator of the Fielding Herbarium, Oxford, for the photographs of Dillenius' specimens, and Dr. P. Goldblatt for investigating some specimens in overseas herbaria.

1. *C. alternifolia* [Dodart, Mem. Histoire des Plantes ed. 1. 73 (1676)—Herman, Horti academici Lugd.-Batavi 191 (1687)—L., Hort. Cliff. 497 (1737)—J. Burman, Rar. Afr. Pl. 58 t. 24. f. 1 (1738)] *L.*, Sp. Pl., ed. 1. 283 (1753).

C. alternifolia cannot be a *Crassula* if the specific epithet is applicable. However, the reference to Herman's (1687) description gives no clear indication of its identity. The illustration in Dodart (1676) clearly shows a species of *Umbilicus*. The further reference to Burman (1738) adds to the confusion as it seems to illustrate *C. pellucida* at first sight, but could also refer to a plant of another genus altogether. The leaves are distinctly alternate, attenuate, serrate and there is a distinct swelling below the petals indicating a calyx tube, an inferior ovary or a capitulum, but none of these characters are found in a species of the *C. pellucida* group. However, Linnaeus must also have felt uncertain about this species, as he did not change the wording in later publications. No specimen can be traced, therefore it cannot be interpreted, but it seems unlikely that it is a species of *Crassula*.

2. *C. caffra* See *C. tetragona*.
3. *C. centauroides* See *C. strigosa*.
4. *C. ciliata* [Boerhaave, Index Plantarum 1: 292 (1720)—Dillenius, Hort. Elth. 116 t. 98 f. 116 (1732)—L., Hort. Cliff., Append. 496 (1737)] *L.*, Sp. Pl. ed. 1. 283 (1753)—Type: Dillenius, Hort. Elth. 116, t. 98, f. 116.

Dillenius' illustration leaves no doubt about the identity of the species concerned and Linnaeus kept his description similar throughout his publications. Linnaeus (1737) includes a reference to Boerhaave (1720), but it its doubtful whether this plant is, in fact, the same, as *C. ciliata* does not have subrotund leaves and also "dentibus albis serratis" hardly refers to a ciliate margin.

5. *C. coccinea* [Breynius, Prodr. Pl. Rar. 3: 30, t. 20, f. 1. (1700)—Commelin, Horti medici Amst. 24 (1706)—L., Hort. Cliff. 116 (1737)] *L.*, Sp. Pl. ed. 1. 282 (1753). Type: sine loc. et leg. in Herbarium Hortus Cliffortianus (BM, holo!).

C. coccinea L. is so characteristic that no difficulty about its interpretation arises. Although it is well illustrated by Commelin (1706) and Breynius (1700) the specimen in the Herbarium Hortus Cliffortianus should receive preference as the type specimen, because Linnaeus marked this species in his own copy of the Species Plantarum ed. 1., meaning that it is represented in that herbarium (cf. notes in LINN). The specimen LINN 400.1 is probably of a later date and it is known that specimens of this species were sent to him several times (cf. Barnard p. 4; Jackson (1918) in Proc. Linn. Soc., Suppl. p. 9.).

6. *C. cultrata* [Dillenius, Hort. Elth. 115, t. 17, f. 114 (1732)] *L.*, Sp.Pl. ed. 1. 283 (1753)—L., Mantissa Altera 361 (1771). Type: Dillenius, Hort. Elth. 115, t. 17, f. 114.

Schonland's (1929) suggestion that the specimen (LINN 400.9) should be taken as the type specimen is not acceptable, as it was deposited in the herbarium much later and "cultrata" added by Linnaeus fil.

7. *C. cymosa Bergius* See *C. subulata L.*

8. *C. dichtoma* [Herman, Horti acad. Lugd.-Batavi 550, t. 553 (1687)]. *L.*, Pl. Rar. Afr. 9 (1760). Type: Herman, Horti acad. Lugd. Batavi t. 553.

The description is remarkably short and seems to have been drawn up from Herman's plate 553 (for discussion see under *C. strigosa*), which is clear and leaves no doubt about the species concerned.

Thunberg (1823) interpreted this species as a "subpetiolate" leafed form of the *C. pellucida*-group in fact, *C. pellucida* itself, according to the specimens in his herbarium. However, Linnaeus fil. interpreted the species both ways, judging by the specimens he identified (LINN 400.12, correct; LINN 400.13, 14, 15 sensu Thunberg).

9. *C. flava* [Burman, Pl. Rar. Afr. 37, t. 23, f. 2. (1738)] *L.*, Mantissa 60 (1767)—Type: Caput Bonae Spei, sine leg. in LINN 400.3 (holo!).

C. flava is based on a specimen (LINN 400.3) inscribed "flava" by Linnaeus which Linnaeus fil. deleted and referred to *C. cymosa*, according to his and Thunberg's interpretation of this species. This specimen is probably the one sent to Linnaeus by Burman in 1764 (Barnard, p. 4).

10. *C. fruticulosa* See *C. tetragona*.

11. *C. glomerata Bergius*, Plantae Capensis 85 (1767)—L., Mantissa 60 (1767)—Type: Cape, *Bergius* s.n. (SBT, holo).
 C. scleranthoides Burman f., Fl. Cap. 8 (1768)—Type: Cape, Burman Herbarium (G, holo!).

Linnaeus' description is antedated by Bergius' publication by about a month. Linnaeus' description is unusually detailed and as he mentioned, must have been drawn up at least partly from a flowering specimen in Hortus Uppsalensis. However, Linnaeus must also have used the fruiting specimen (LINN 400.16) probably sent to him by Burman (cf. *C. flava*) and a specimen in a similar stage of development as the one found in Burman's Herbarium. *C. sclerenthoides* Burman f. which obviously refers to the same species, is probably based on the similar specimen in the Burman collection (see Barnard, p. 19). Hence, Burman's description "floribus ultimis capitatis", and thus refers to a fruiting specimen. The name *C. scleranthoides* was never written onto the specimen and only "*C. glomerata*" in N. L. Burman's hand is found on this sheet.

12. *C. imbricata* Burm. f. See *C. muscosa L.*

13. *C. muscosa L.*, Pl. Rar. Afr. 10 (1760)—Sp. pl. ed. 2.: 405 (1762)—Mantissa altera 361 (1771). Type: Cape, sine leg. in Burman Herbarium (G, holo!).
 C. imbricata Burm. f., Fl. Cap. 8 (1768). Type as for *C. muscosa.*
 C. lycopodioides Lam., Dict. 2: 173 (1786). Type: Africa, Lamarck (P–LA, holo).

Schonland placed *C. muscosa* hesitantly under *C. lycopodioides*, but from the original description of the species it seems that Linnaeus was indeed referring to this species: "foliis . . . caulem obtengentibus, floribus sessilibus". Although it might be inferred from "Caules filiformes . . ." underlined by "caule herbaceo prostrato" added by Linnaeus in 1762, that one of the species, *C. campestris* or *C. parvula* was intended. These are excluded by continuing "Caules . . . rarius ramosi" and "Foliis ovatis, carnosis obtusiusculis, in exiccatis sub foliorum margine ordo punctorum". The latter referring to the clearly visible hydathodes. This description must have been drawn up only from a specimen, and the reference to Herman (1698)—which apparently refers to *C. campestris*—did not contribute to the preparation of the description. In fact, Linnaeus (1771) himself excludes the latter reference.

A Burman specimen inscribed apparently by J. Burman "*C. imbricata*", the name Linnaeus had originally sent to N. Burman (see Barnard, p. 3,5), or more likely, Linnaeus accepted the name J. Burman had previously written on the sheet, otherwise Linnaeus would have written the name he had envisaged first, as he had done with *C. dichotoma* and *C. strigosa*, plants of the same consignment. However, later Linnaeus seems to have preferred Herman's epithet "muscosa" and as such it was published.

This Burman specimen shows a few single flowers, a character unusual for that species, yet mentioned by both Linnaeus and N. L. Burman in their respective descriptions. Judging by this, the spreading leaves and unusually exposed internodes, it appears that the specimen belongs to a form occurring in the vicinity of Saldanha Bay and which was later described by Ecklon & Zeyher as *Tetraphyle littoralis*.

This specimen is, therefore, the type specimen of *C. muscosa L.* and *C. imbricata* N. L. Burman, the latter being described without Burman's knowledge of Linnaeus' publication.

14. *C. nudicaulis* [Dillenius, Hort. Elth. 116, t. 98, f. 115 (1732)] *L.*, Sp. Pl. ed. 1: 283 (1753)—Type: Dillenius, Hort. Elth. 116, t. 98, f. 115.

Dillenius' illustration leaves no doubt as to the species concerned.

15. *C. obvallata L.*, Mantissa 61 (1767).

This species can clearly be recognised from the description of the peculiar petals and rather broad, slightly oblique leaves. From the description it is clear that Linnaeus used a live specimen, but no specimen has been preserved. However, this species must be relegated to the synonymy of *C. nudicaulis*, a local narrow-leafed form of this widespread species.

16. *C. orbicularis* [Dillenius, Hort. Elth. 119, t. 100, f. 119 (1732)] *L.*, Sp. Pl. ed. 1. 283 (1753)—Fl. Cap. (1760), *orbiculata*. Type: Dillenius, Hort. Elth. 119, t. 100, t. 119.

Dillenius' figure illustrates the species clearly.

Of the three specimens that Linnaeus fil. identified as *C. orbicularis*, LINN 400.27 and 400.28 are probably the leaf rosette of this species, but an inflorescence of a plant of the section Globulea has been added to specimen 400.27. Specimen 400.29 must be identified as *C. quadrangularis* Schonl.

17. *C. pellucida* [Dillenius, Hort. Elth. 119, t. 100, f. 119 (1732)] *L.*, Sp. Pl. ed. 1. 283 (1753). Type: Dillenius, Hort. Elth. 119, t. 100, f. 119.

Dillenius' figure illustrates the species clearly and Linnaeus never altered or added to the description.

18. *C. perfoliata* [Commelin, Praeludia Botanica 74, f. 23 (1703) –*Dillenius*, Hort, Elth. 114, t. 96, f. 113 (1732)] *L.*, Sp. Pl. ed. 1: 282 (1753)—Miller, Dict. t. 108 (1760). Type: Promontorium Bonae Spei, *Dillenius* s.n. (OXF, lecto, photo!).

Although Linnaeus cites the illustrations of Dillenius and Commelin, the former should receive preference as it bears flowers and is accompanied by a voucher specimen. In more recent publications, the name *C. perfoliata* is generally linked with the red flowered form of this species, but the illustrations of Dillenius and Miller leave no doubt that it was the white flowered variety that was first known in Europe. It was probably brought back from Schrywer's expedition from the vicinity of the present Aberdeen. These two forms are not only different in their petal colour, but also in the length of the petals. The two plants are never found at the same locality, although the distribution areas would suggest an overlap, and it would appear that the two are ecologically separated.

It is interesting to note that Dillenius calls this plant "Crassula altissima perforata" while Linnaeus quoted him ". . . perfoliata", and hence the epithet.

1. var. *perfoliata*

C. perfoliata L., Sp. Pl., ed. 1. 282 (1753).

Plant erect up to 1,5 m high, little branched, mainly from the base. *Leaves* lanceolate usually with a broad base abruptly constricted into the upper half, canaliculate. *Flowers* with obtuse petals 3–4 mm long, white to yellowish-green, but stamens and ovary often pink.

Occurring in succulent shrub, usually in mountainous areas from north of Port Elizabeth to Graaff-Reinet and Willowmore.

2. var. **miniata** *Toelken*, var. nov. ab var. *perfoliata* petalis acutis (5–) 6—7 mm longis et miniata.

C. falcata Wendl., Bot. Beobacht, 44 (1798)—Willd., Enum. 341 (1809)—Sims in Bot. Mag. t. 2035 (1818)—Pole Evans, Fl. Pl. of S. Afr. 1: 12 (1921)—Schonl. in Trans. Roy. Soc. S.A. 17: 225 (1929).

C. perfoliata sensu Schonl. in Trans. Roy. Soc. S. Afr. 17: 224 (1929), partly.

Plantae erectae, 0,15—1 m altae rare non ramosae. *Folia* lanceolata et canaliculata, vel falcata et plana. *Flores* petalis acutis (5-) 6—7 mm longis, miniati rare rosei.

Type: Cape, Pluto's Vale near Grahamstown, *Tölken* 4280 (BOL, holo).

Occurring on rock outcrops in grassveld or in dry shrub vegetation usually associated with valley bushveld around the lower Sundays and Fish Rivers, but also as far east as Idutywa in the Transkei and odd localities near Steytlerville and Willowmore in the west.

This variety can be divided into two more or less clear groups, namely those plants with falcate leaves which usually grow in rocky outcrops in grassveld and which are known as *C. falcata*; and secondly, the form with lanceolate canaliculate leaves which usually grow in dryer vegetation of the valley bushveld. However, just north of Port Elizabeth a form occurs that exhibits falcate leaves at the base, becoming more and more lanceolate and canaliculate higher up (cf. *Wisura* 152). Even the width of the falcate leaves which is usually double that of the others, becomes unusable as a taxonomic character east of East London, as the leaves of all plants become progressively narrower towards the east. The form with falcate leaves cannot be sufficiently clearly delimited to justify taxonomic rank, nor can the transition near Port Elizabeth be attributed to a hybrid swarm as the leaf shape is remarkably constant in all the populations investigated.

It seems ill advised to amend the description of *C. falcata* and use it for this variety, as the name has become so entrenched in literature for the form with falcate leaves that is so well known in horticulture.

19. *C. portulacaria* [Dillenius, Hort. Elth. 120, t. 101, f. 120 (1732)—L., Hort. Cliff. 207 (1737)) *L.*, Sp. Pl. ed. 2. 406 (1762). Type: Dillenius, Hort. Elth. 120, t. 101, f. 120.

C. arborea L., Fl. Cap. Amoen. Acad. 5: 365 (1760), *nomen nud.*

Claytonia portulacaria (L.) L., Mantissa Altera 362 (1771).

Linnaeus seemed to be rather uncertain about the identity of this species, from the way it is alternatively omitted and cited in his publications. Finally, in 1771 he transferred it to the genus *Claytonia.* Although Dillenius' figure has no flowers, it can be recognised as illustrating *Portulacaria afra* and not a *Crassula.*

20. *C. pruinosa L.*, Mantissa 60 (1767)—Burm. f., Fl. Cap. 8 (1768).
Type: Caput Bonae Spei, sine leg. in LINN 400.4 (holo!).

The type specimen, LINN 400.4 must be identified as *C. scabra* var. *minor* Schonl., which is common on rocky outcrops in the northern Cape Peninsula. Also, the description gives a strong indication of the plant concerned by "uti tota planta pruinosa crystallina", while the plant from the Bokkeveld, etc. does not show these trichomes so clearly and has very few below the inflorescence and on the calyx.

Thunberg's specimen (UPS 7783) can also be recognised as this species by the dense inflorescence and the shorter petals, but it does not grow in the Karoo, as is stated in his Flora Capensis p. 283.

Therefore, the plant interpreted by Schonland (1929) as *C. pruinosa* is described.

C. pustulata *Tölken*, sp. nov., ab *C. pruinosa* sepalis plerumque glabris rare papillis paucis et petalis 7—8 mm longis differt.

C. pruinosa sensu Harv., Fl. Cap. 2: 346 (1861)—sensu Schonl. in Trans. Roy. Soc. S.A. 17: 222 (1929).

Plantae erectae saepe fastigiatae, (10-) 14—20 cm altae, ramulis multis 1 mm in diametro rare 2—3 mm ad basim, trichomatibus adpressis tengentibus caule et folia; trichomata in internodiis pili recurvati adpressi et in foliis pili adpressi apice basifugo acuto et apice basipetalo bicorni rare mutico. *Folia* lanceolata rare lineares, acuta, 0,5—1,4 cm longa, plerumque 0,2 mm lata fere teretia sed plerumque supra plana, griseo-virides vel griseo-fusca. *Inflorescentia* terminalis plerumque dichasiis duobus, laxa, (1-) 3–8 (-14) floribus. *Sepala* lineo-lanceolatis, acuta, 4—5 mm longa impariter, plerumque glabra rare papillis paucis. *Petala* elliptico-lanceolata, 7—8 (–9) mm longa, saepe appendice subterminali ut videtur terminali, circiter 3 mm connata, reflexa, denticulata, alba vel pallida flava. *Stamina* 6—7 mm longa antheris atro-bruneis. *Squamae* cuneiformes leviter constrictae ad bases, leviter emarginatae, 0,2 × 0,2—0,3 mm, carnosae, flavae. *Carpellum* gracile, 10—14 ovulis vix tuberculatis.

Type: Cape, Clanwilliam, Pakhuis Pass, *Tölken* 4256 (BOL, holo).

Plants erect often fastigiate, (10–) 14—20 cm high, much branched with wiry branches 1 mm rarely 2—3 mm thick at the base, with lower branches often rooting, with trichomes convering most parts of the plant; trichomes recurved adpressed hairs on the internodes, adpressed hairs with an acute apex basifugally and with two lateral points basipetally. *Leaves* linear-lanceolate, acute, 0,5—1,4 cm long, 0,1—0,2 cm broad, almost terete with upper surface usually flat, erect or spreading, grey-green to greyish-brown; sheath 1—1,5 mm long. *Inflorescence* terminal usually with two dichasia, with (1–) 3—8 (–14) flowers in a lax flat-topped cluster. *Sepals* linear-lanceolate drawn into a point, 4—5 mm long uneven, usually glabrous rarely with few small papillae. *Petals* elliptic-lanceolate, often pointed as subterminal appendage appears to be terminal, fused up to 3 mm, reflexed, 8—10 mm long, 2 mm broad, denticulate, white or light yellow. *Stamens* 6—7 mm long with dark brown anthers. *Squamae* wedge-shaped, but only slightly tapering to the base, slightly emarginate, 0,2 × 0,2—0,3 mm, fleshy, yellow. *Carpel* slender with 10—14 ovules hardly tuberculate; style about as long as ovary with red subterminal stigma.

Growing in sandy depressions or in deep pockets of sand on rocks, always associated with sandstone, occurring in the mountainous areas from the Bokkeveld in the south to the Gifberg in the north.

21. *C. punctata L.*, Fl. Cap. 13 (1759), nomen—Syst. Nat. ed. 10, 969 (1759)—Sp. Pl. ed. 2: 406 (1762)—non sensu Miller, Dict. (1768).

It is unlikely that this species is synonymous with *C. ramuliflora* as Schonland suggested, as the area in which it grows became known botanically much later. Also, *C. ramuliflora* is usually covered with hairs and the upper and lower leaves on the stem are not distinctly different as Linnaeus (1762) described. This, and the recurved petals mentioned, indicate *C. corymbulosa* as this species fits the description in all respects and could have been introduced into European gardens by Schrywer from his expedition to Graaff-Reinet. According to Linnaeus, this species is based on a Burman specimen and, until this is found, no certainty of the true identity can be ascertained from the description alone.

C. punctata sensu Miller (1768) refers to *C. perforata* because of their flaccid stems and cordate leaves, unlike *C. rupestris* as Schonland suggests.

22. *C. rubens* (*L.*) *L.*, Syst. Nat. ed. 10: 969 (1759).

Sedum rubens L., Sp. Pl. ed. 1: 432 (1753)—Sp. Pl. ed 2: 619 (1764).

A European species of Sedum.

23. *C. scabra* [Martyn, Hist. Plant. 24, t. 24 (1728)—Dillenius, Hort. Elth. 117 (1732)] *L.*, Sp. Pl. ed. 1: 283 (1753).

Type: Dillenius, Hort. Elth. 117, t. 99, f. 117.

C. scabra is well illustrated by Martyn (1728) and Dillenius (1732), but Schonland (1929) designated the Dillenius specimen as the type specimen. This cannot be accepted as the specimen could not have been used for the plate, as mentioned earlier (cf. Clokie, 1964). However, Dillenius' plate should receive preference because, judging from the length of the petals, the Martyn specimen could have been a hybrid found commonly on the northern slopes of Table Mountain.

24. *C. sclerenthoides* Burm. f. See *C. glomerata L.*

25. *C. strigosa L.*, Pl. Rar. Afr. 10 (1760)—Type: Caput Bonae Spei, in Burman Herbarium (G, holo!).

C. centauroides L., Pl. Rar. Afr. 9 (1760)—Sp. Pl. ed. 2, 454 (1762)—Amoen. Acad. 6: 85 (1763). Type: Caput Bonae Spei, in Burman Herbarium (G, holo!).

C. sylvatica Licht. ex Schultes 6: 726 (1820)—Type: unknown.

Although Linnaeus does not specifically state it, it can be inferred from letters that *C. strigosa* is based on a Burman specimen (Barnard, p. 2, 3). In fact, the specimen in the Burman Herbarium has "Crassula strigosa" apparently in Linnaeus' handwriting on it. This must be the type specimen, as it agrees in all respects with the original description. *C. sylvatica* is thus synonymous with *C. strigosa*, as Schonland tentatively indicated.

Linnaeus (1760) described four new species of Crassulas (*C. strigosa*, *C. dichotoma*, *C. centauroides*, *C. muscosa*) which were probably based on Burman specimens, although this is not stated clearly in this publication (see Barnard, p. 2, 3). In the Burman collection (G) there are two specimens inscribed with what seems to be Linnaeus' handwriting, namely "Crassula strigosa" and "Crassula dichotoma", however, they belong to the same species. The specimen with "Crassula strigosa" is the type of that species. The description of *C. dichotoma* is remarkably short and does not agree with the abovementioned second specimen. This latter specimen agrees with the description of *C. centauroides* in the following points: (1) "Caulis superne dichtome corymbosus"; (2) "ex axilis flores pedunculati, ramis breviores"; (3) he does not state the habit of the plant which is not distinct from the specimen, but described the distinctly erect habit of *C. dichotoma*. Particularly as the latter description is not separated by its own number from *C. centauroides* in both the original the thesis (1760) and in Amoenitates Academicae 6 (1763), it is unlikely to be merely a printing error.

Therefore, the author suggests that Linnaeus became uncertain when describing this species, because the specimen which he inscribed "*Crassula* *dichotoma*" did not show this type of branching on the whole plant. The short diagnostic description in comparison with those of other species in this publication and the narrow leaves mentioned, seems to indicate that this description was drawn up from Herman's illustration (1687). Yet, in the case of *C. centauroides*, the reference to Herman (1698) seems to have contributed nothing towards the description. In fact, Herman appears to refer to the same species in both these publications, whereas Linnaeus states that the two species can be distinguished by *C. centauroides* having broader leaves and smaller flowers. This is true if the specimen is compared with the illustration as mentioned above.

Having accepted that the specimen inscribed "Crassula dichotoma" is the type of *C. centauroides*, the description of the leaves as amplexicaul, sessile, smooth in *C. centauroides* may be found questionable when one thinks of the species involved. Yet, on superficial investigation, the leaves of the Burman specimen might well seem to be sessile and amplexicaul, because the petioles are adpressed to the stems due to the way the specimen was dried. In addition, the lower leaves are almost glabrous so that the unusual description of the leaves adds proof to this interpretation.

According to the above interpretation *C. centauroides* is thus synonymous with *C. strigosa* L., as J. Burman had correctly recognised, and had written "strigosa" over Linnaeus' inscription "Crassula dichotoma".

Throughout his subsequent publications, Linnaeus treated the two as separate species and did not change the description. In the Mantissa Altera (1771), however, a description of vegetative parts of *C. centauroides* is added. It is not clear to which plant he is referring, but it certainly does not fit the species as interpreted above, nor to a species of the *C. pellucida*-group as Thunberg, Linnaeus fil. and subsequent workers have interpreted this species. The phrase (Linnaeus 1771) "Folia . . . carnosa, supra punctatis excavatis", obviously refers to hydathodes, and cannot apply to any of the herbaceous Crassulas, as Linnaeus clearly stated in his original description. Could Linnaeus have returned the specimens to Burman before he compared the plants, when he was drawing up his second description?

26. *C. subulata* [Herman, Horti acad. Lugd.—Batavi 550, t. 552 (1687)] *L.*, Syst. Nat. ed. 10, 969 (1759)—Sp. Pl. ed. 2, 404 (1762)—Mantissa Altera 360 (1771)—non sensu Bergius, Fl. Cap. 83 (1767)—Type: Herman, Horti acad. Lugd.—Batavi t. 552.

C. cymosa Bergius, Pl. Cap. 84 (1767)—L., Mantissa Altera 122 (1771). Type: Cape, *Bergius* (SBT, holo).

C. ramosa Thunb. in Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 330 (1778)—Prodr. 55 (1794)—Fl. Cap. ed. Schultes 284 (1823)—Type: Cape, Swartkops River, *Thunberg* in UPS 7788 (microfiche).

The diagnosis of *C. subulata* L. (1759) and (1762) fits the illustration of Herman (1687) and it was probably drawn up from this figure as Linnaeus seems to have produced rather short descriptions when no specimen of the plant was available (cf. *C. dichotoma*). Linnaeus (1762), in fact, expresses his uncertainty about this species, yet keeps the diagnosis unaltered throughout subsequent works, except in Matissa Altera he adds to it under observations. This first reference added, Pet. gaz. t. 89, f. 8. at first glance appears to be similar, but it clearly shows broad reflexed petals unlike Herman's illustration (1687) and seems to be a poor drawing of *C. cymosa* sensu Schonland (1929) or *C. flava* L. However, it is difficult to identify it with certainty. The second one, Bergius Pl. Cap. 83, he himself adds the reservations that it has red flowers, but continues with a description, some phrases of which were directly taken from Bergius' description. Bergius was referring to *Rochea odoratissima* DC. in which the flowers often turn red when they become older. Linnaeus even identified a specimen of *R. odoratissima* (LINN 400.21) as *C. subulata*. This interpretation was followed by many subsequent workers.

C. cymosa Bergius is synonymous with *C. subulata* L. ("Folia linearia, untrinque glabra acutiuscula . . . Corolla . . . laciniis linearilanceolatis acutiusculus . . ."), but Linnaeus follows Bergius incorrectly in so far that he accepts Bergius' interpretation and even uses some of his phrases when he described *C. cymosa* in Mantissa Altera. *C. cymosa* sensu Thunb. refers to *C. flava* L. (*Thunberg* in UPS 7749). *C. cymosa* sensu Schonl., and many other authors, has been so well established under this epithet that no later synonyms can be found and consequently it is described here as *C. arenicola*.

C. ramosa Thunb. must also be referred to the synonymy of *C. subulata* and although it is a rather stout specimen (*Thunberg* in UPS 7788) it shows the pointed leaves, very dense inflorescence and the typically pointed petals.

C. arenicola *Toelken*, sp. nov., ab *C. subulata* foliis planis in basibus plantarum muticis ciliis expansis, petalis ellipticis obtusis.

C. cymosa sensu Schonl. in Trans. Roy. Soc. S. Afr. 17: 216 (1929).

Plantae usque ad 35 cm altas, multis ramis ad basim, ramis majoribus decumbentibus et inflorescentis erectis. *Folia* lineari-elliptica, vix contracta ad basim et apicem, plerumque mutica, (1–) 2—3 (–4) cm longa, 0,2—0,4 cm lata, erecta, plana, glabra, ciliis marginalibus expansis rare recurvis, virides vel flavovirentes. *Inflorescentia* terminalis, ramosa dichasiis pluris floribus multis; pedunculus 15—25 cm longa. *Sepala* lanceolata, mutica, inaequales 1,5—2,5 mm longa, glabra, virides. *Petala* elliptica, obtusa, 3—4 mm longa, reflexa, c. 1 mm connata, pallide flava vel eburnea. *Stamina* 2—3 mm longa antheris atrobruneis. *Squamae* oblongae vix contracta ad medium, 0,7—0,8 × 0,4—0,5 mm, pallide flava. *Carpellum* ovario gracili 10—12 ovulis, stylo circiter dimidio longo quam ovario, stigmate terminali.

Type: Cape, Clanwilliam, Pakhuis Pass, *Tölken* 4255 (BOL, holo).

Plants up to 35 cm high, much branched at the base, with main branches decumbent and erect inflorescences. *Leaves* elliptic-linear to strap-like, slightly tapering to both ends and usually with a blunt apex, (1–) 2—3 cm long, 0,2—0,4 cm broad, erect, flat, glabrous with marginal cilia which are usually erect rarely slightly recurved and with a swollen apex, green to yellowish-green; sheath 1—2 cm long. *Inflorescence* terminal, branching with several dischasia with many flowers; peduncle 15—25 cm long. *Sepals* lanceolate with blunt apex, 1,5—2,5 mm long unequal, usually glabrous, green. *Petals* elliptic, obtuse or with blunt apex, 3—4 mm long, reflexed, c. 1 mm fused, light yellow or cream. *Stamens* 2—3 mm long with dark brown anthers. *Squamae* oblong, slightly constricted in the middle, 0,7—0,8 × 0,4—0,5 mm, light yellow. *Carpel* with slender ovary with 10—12 ovules, with style about half as long as ovary and with terminal stigma.

Growing on sandy slopes but usually in shallow sand and usually in open vegetation on the Cape Flats and the adjoining mountain slopes from the Cape Peninsula to the Gifberg extending to Hondeklip Bay along the coast.

27. *C. tetragona* [Boerhaave, Index Plant. 1: 292 (1720)—L., Hort. Cliff. 116 (1737)] *L.*, Sp. Pl. ed. 1. 283 (1753)—Sp. Pl. ed. 2. 404 (1762)—Mantissa Altera 361 (1771). Type: Caput Bonae Spei, sine leg. in LINN 400.6 (holo!).

C. fruticulosa L., Mantissa 61 (1767).
Type: unknown.
C. caffra L., Mantissa Altera 222 (1771).
Type: unknown.
C. acutifolia Lam., Dict. 2: 175 (1786).
Type: Africa, *Lamarck* (P–LA, holo).

Linnaeus' (1753) description of *C. tetragona* does not give an indication of whether he was dealing with *C. tetragona* or *C. acutifolia* in the way Schonland (1929) interpreted these species. He refers, however, to his earlier work in Hortus Cliffortianus (1737) where he had given a more detailed description, partly that of van Royen's. The only indication that he is referring to *C. tetragona* sensu Schonl. in reflected in the height of the plant being given as 1—3 ft, whereas *C. acutifolia* rarely grows higher than 1 ft. On the other hand the description indicates reference to *C. acutifolia* in the following ways. Firstly, "folia . . . carnosa patentia" indicates leaves unlike those of *C. tetragona* sensu Schonl. as they are usually bent upwards, a point mentioned by Linnaeus (1762), and therefore the above citation is unlikely to refer to this species. Secondly, the inflorescence is described as an "umbella" probably referring to the flat-topped thyrse found in *C. acutifolia*, whereas the inflorescence of *C. tetragona* sensu Schonl. is much branched and irregular. From this it appears

MARY GUNN LIBRARY
NATIONAL BOTANICAL INSTITUTE
PRIVATE BAG X 101
PRETORIA 0001
REPUBLIC OF SOUTH AFRICA

that both species were known to Linnaeus. As the height of the plant is given as 1—3 ft it seems that Linnaeus regarded both plants as one species, but the description was drawn up predominantly from a specimen of *C. acutifolia*. The specimen (LINN 400.6) must have been incorporated in the herbarium before 1748 as "Crassula" is written at the top of the sheet together with "tetragona" in Linnaeus' hand leaves no doubt that this specimen must be accepted as the type (Savage 1945, Catalogue of the Linnaean Herbarium). The additional information Linnaeus added in 1762 seem to be derived from Bradley's, Hist. Pl. Succ. 5: 18, t. 11, fig. 41 (1732), which illustrates typical *C. robusta*.

Later, however, Linnaeus realised that the two plants were different when he described *C. fruticulosa*. He specifically stated that they were similar in habit, but *C. fruticulosa* was distinguishable from *C. tetragona* as it grew up to 1 ft, whereas the latter grew 3—4 ft high. Unfortunately, this description was drawn up only from vegetative material, so that one cannot be absolutely certain that Linnaeus was not referring to yet another species, particularly as there is no specimen preserved.

Then in 1771 Linnaeus described *C. caffra* which cannot be distinguished from *C. fruticulosa* in vegetative characters and, in fact, the description could have been drawn up from a specimen of *C. tetragona* mentioned earlier. However, he did not mention in what way *C. caffra* differed from *C. fruticulosa* or *C. tetragona*.

In the same publication, under observations, Linnaeus mentioned how easily plants of *C. tetragona* produce adventitious roots when kept dry, a character mainly found in *C. tetragona* sensu Schonl. and to a much lesser degree in *C. acutifolia*. Later Linnaeus seems to have clearly distinguished the larger plant as *C. tetragona* and he also referred to the clear illustration of Bradley's (1732).

C. tetragona must either be rejected as a nomen confusum, or, as it is accepted here, must be interpreted according to the perfectly clear type specimen, which belongs to the same species as *C. acutifolia*. *C. tetragona* thus supersedes *C. acutifolia* Lam. The only later name for the more robust species is *C. decussata* Salisb. which is a nomen nudum, and therefore *C. robusta* is described.

C. robusta *Tölken*, sp. nov, ab *C. tetragona* habitu robusto plantis 30—80 cm altis, caulibus carnosis (0,2–) 0,3—1,5 cm in diametro cortice confringenti et caduco et foliis (0,4–) 0,5—0,7 cm latis ad bases differt.

Plantae erectae (3)– 40—80 cm altae, glabrae, ramosae, ramis carnosis (0,2) 0,3—1,5 cm in diametro, cortice confringenti et caduco. *Folia* lanceolata, subulata, (1,5–) 2—3 (–4) cm longa, (0,4–) 0,5—0,7 cm lata, fere teretia sed supra et inferiora aliquantum complanata, apice flexo basifuge. *Inflorescentia* terminalis, thyrsiformis, ramis pluribus et floribus multis, ut videtur pileata;

pedunculus 2—5 cm longus. *Sepala* laneolata, mutica, 0,5—1 mm longa, glabra, virides. *Petala* elliptico-lanceolata, 1,5—2 mm longa, recurva vel reflexa sed erecta fructu, c. 0,5 mm connata, alba vel eburnea. *Stamina* 2—2,5 mm longa antheris atrobruneis. *Squamae* transverse anguste rectangulares, leviter constrictae ad bases, emarginatae, 0,3 × 0,6—0,7 mm, carnosae, pallide flavae vel albae. *Carpellum* ovario 8 (–10) ovulis vix tuberculatis.

Type: Cape, Pluto's Vale near Grahamstown, *Tölken* 4281 (BOL, holo).

Plants erect (30–) 40—80 cm high, glabrous, branched, with fleshy branches (0,2–) 0,3—1,5 cm in diameter with flaking bark on the older stems. *Leaves* lanceolate, subulate, (1,5–) 2—3 (–4) cm long, 0,5—0,7 cm broad, almost terete with the upper and the lower surface only slightly flattened, arched upwards, glabrous, green sometimes yellowish-green; sheath rarely longer than 1 mm. *Inflorescence* terminal, thyrsoid, with many branches and numerous flowers and often with many bracts along the branchlets; peduncle 2—5 cm long. *Sepals* lanceolate with blunt apex, 0,5—1 mm long, glabrous, green. *Petals* elliptic-lanceolate, 1,5—2 cm long, recurved or reflexed but erect when fruiting, c. 0,5 mm fused, white or cream. *Stamens* 2—2,5 mm long with dark brown anthers. *Squamae* a transversely compressed rectangle very slightly constricted towards the base, 0,3 × 0,6—0,7 mm, light yellow or white. *Carpel* with ovary having 8 (–10) ovules, with style c. 1 mm long and terminal stigma.

Growing in sheltered valleys or between other plants, but rarely in the shade, in dry shrub vegetation mainly associated with the Fish—, Sundays—and Groot River valleys in the Eastern Cape.

28. *C. verticillaris L.*, Mantissa Altera 361 (1771).

This seems to be an European species that will require a complex evaluation because no specimen has been preserved. However, the complex does not involve either *C. campestris* or *C. zeyheriana* as might be apparent from the description. The two specimens of the former (LINN 400.19, 20) could not have been used for the description of *C. verticillaris*, as neither of them is much branched. *C. zeyheriana* Schonl. was brought to Europe by Thunberg and, in fact, *C. debilis* Thunb., Fl. Cap. ed. Schultes 280 (1823) must be taken up. An unmistakable type specimen is to be found in the Burman Herbarium (G!).